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# **Industrial traumatism and occupational morbidity in mining industry of Kazakhstan**

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## **Significance for public health**

This article indicates that the criteria for safety and harmless working conditions are the preservation of life, health, functional abilities of the body, life expectancy, health of future generations. As a result of occupational diseases and work-related accidents, injuries, according to the ILO and WHO, 2 million people die a year. 160 million new cases of occupational diseases are registered annually. Almost half of the world's population is the world's workforce, which supports the material and economic basis of society, therefore, maintaining the health of workers is not only a prerequisite for high labor productivity, but also a guarantee of sustainable socio-economic development of the countries of the world.

## **Abstract**

This article presents data in the dynamics on industrial injuries and occupational morbidity in the mining industry of the Republic of Kazakhstan. The aim of this study is to analyze occupational injuries and occupational diseases between 2008 and 2018. An analysis of the number of victims of accidents, including those who died from accidents at work during the period, shows indicators of occupational injuries in the gender aspect, the outcome of accidents by degrees of severity and the material consequences of accidents. During the analyzed period, the overall level of occupational injuries and occupational morbidity in the country remains high. The material consequences of accidents, in addition to social damage, bring great material losses to the state.

**Key words:** working conditions, mining industry, industrial traumatism, Kazakhstan, accidents, occupational diseases, factors of the working environment.

## **Introduction**

According to the World Health Organization, industrial traumatism is one of the most significant problems in most countries. About 125 million cases of work-related injuries are registered in the world every year. On average, there are about 220 thousand fatal accidents. Today, the mortality rate of the population due to injuries sustained at work ranks third, more often deaths occur only from heart and oncological diseases. In addition, about 160 million cases of occupational diseases are recorded annually [1].

Occupational morbidity is a generally accepted criterion for the harmful effect of unfavorable working conditions on the health of workers [2].

According to the statistics of the International Labour Organization, every three minutes as a result of an accident or occupational disease in the world, one person dies, and every second four workers are injured [3]. At the same time, numerous studies of scientists from many countries of the world show that the share of harmful and dangerous factors generated by the working environment accounts for up to 30% of the causal consequences of health deviations [4, 5].

According to the Statistics Agency, enterprises of the Republic of Kazakhstan are not sufficiently provided with safety equipment, sanitary appliances, and personal protective equipment. Laboratory studies of the air in the working area in 40.8% increase the content of dust and gases in the air. For physical factors, 39.4% of objects, for noise 16.5%, for vibration 39.3%, for microclimatic working conditions and lighting 38.2% do not meet sanitary standards [6].

The largest number of those working in unfavorable working conditions in all aspects falls on the mining industry of the Republic. The number of people working on equipment that does not meet safety requirements in the mining industry is 44% [7].

The highest level of occupational morbidity in the regions is observed in the Karaganda (27.4 per 10,000 workers) and East Kazakhstan (18.0 per 10,000 workers) regions. В которых сосредоточены крупные предприятия горнодобывающей отрасли Казахстана [8]. In which large enterprises of Kazakhstan's mining industry are concentrated.

Mining represents an important source of income worldwide [9]. Kazakhstan's position in the world market of metals is specified, the influence of the mining and metallurgical industry (MMI) on the macroeconomic performance of the country is highlighted. It is shown that the MMI sector has 13% in GDP, 23% in the overall commercial production, 48% in the process industry and 20% in the export of the country [10].

Industrial accidents are a serious business risk. The constant increase in the underground mining industry has led to the use and implementation of new technologies and the use of different substances for the processing and extraction of minerals, which increases the risks in the activities that develop in the mine [11]. The increase in activity increases labor directly or indirectly and is proportional to the increase in risks, injuries and even deaths [12].

Some of the most common causes of occupational diseases and accidents in underground mining are: environmental risks, risks of physical and mental overload and risks derived from specific sources [13]. Environmental risks are factors that are present in the working environment and that impede the proper performance of work, these risks can include physical, chemical and biological contaminants [14]. Physical contaminants are environmental conditions from different point sources, such as noise, temperature, lighting, vibrations, etc. Being exposed to them can directly or indirectly affect the human body [15]. Chemical contaminants are those that are constituted by inert matter in the form of solids, gases, vapors, dust, fumes, etc., which when in contact with a worker, can cause moderate to severe damage [16]. Biological contaminants are agents generated by microorganisms that can cause some type of infection, allergy and intoxication, some of these contaminants are bacteria, viruses, fungi, parasites, etc. When the human body is subjected to some strain to perform certain activities, the individual may be exposed to risks of physical and mental overload. Ergonomic and psychosocial risks also fall under this category [17]. Ergonomic risks relate to tasks performed by the worker which can lead to them suffering damage to sensitive parts of the musculoskeletal system. This can be caused by, for example: over exertion when lifting a load, repetitive movements that can cause injuries and inadequate postures [18]. Psychosocial risks consist of

anxiety and stress disorders which constitute inadequate work conditions, caused by, for example: traumatic events and workplace violence [19].

Another category of factors that affect workers in the work environment are mechanical and electrical risks. Mechanical risks are caused by the use of machines that can cause entrapment, dismemberment, particle projection, falls, blows, etc. Electrical risks are caused by electrical installations or equipment, which can cause electric shocks, fires or explosions due to overloads or short circuits in conductors [20].

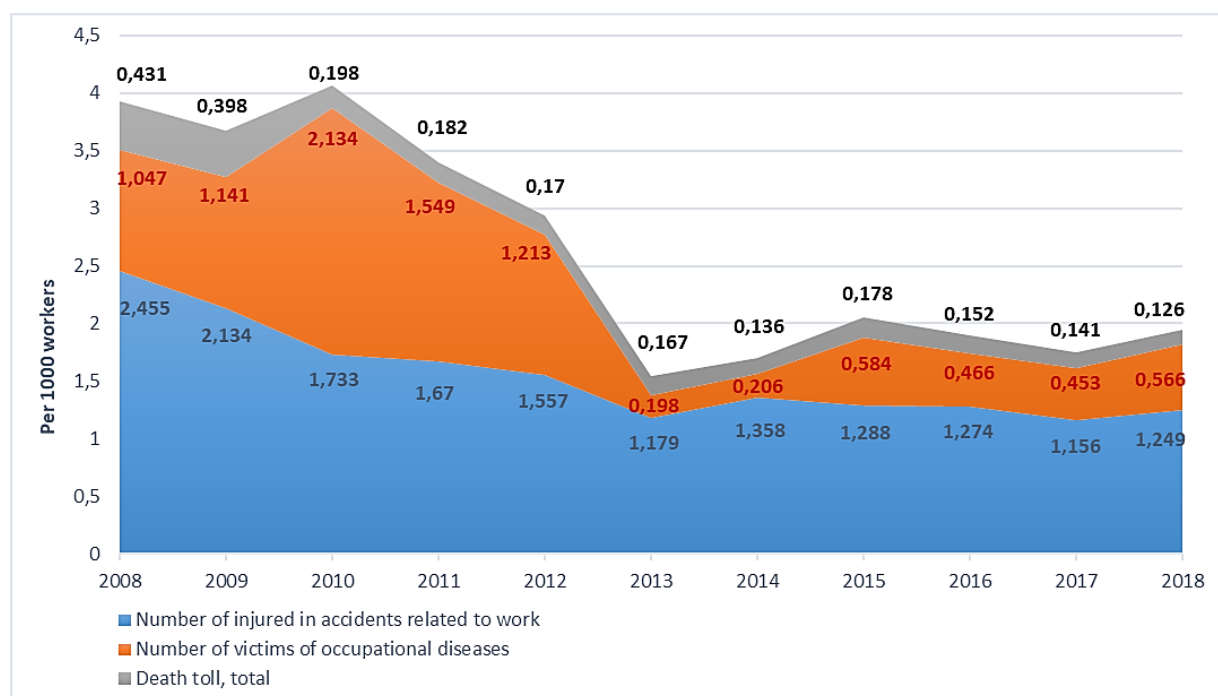
## **Materials and Methods**

This report was compiled on the basis of an analysis of statistical data for 2008 - 2018 provided by Agency of the Republic of Kazakhstan for Statistics, the title of the bulletin (index 7-TOD) "On work-related injuries and occupational diseases in the Republic of Kazakhstan." We also reviewed the literature on this topic in scientific databases: ScienceDirect, MEDLINE, Google Scholar and others. Articles were analyzed and selected throughout 2020.

## **Results**

According to official statistics in the Republic of Kazakhstan for 2018, about 16.7 million people work in unfavorable and harmful conditions, of which 195.8 thousand people work in the mining industry. Compared to the total number of identified occupational diseases, the East Kazakhstan and Karaganda regions are leading by a wide margin, these regions account for more than 90% of cases of diseases. This is not accidental, since practically all of the republic's Mining and Milling industry is concentrated in these areas. The explanation for this is the impact on workers of harmful and difficult working conditions in these industries, where the risk of occupational diseases is very high. The mining industry is one of the leaders with the highest production rates, due to the use of most of the labor resources and the use of manual labor, mainly determine the level of industrial traumatism, which confirms their unfavorable working conditions in terms of work place safety. An analysis of the number of victims in the mining industry showed that in 2013 there is a minimum level of occupational morbidity for the entire analyzed period, compared to 2010, when there was a peak occupational morbidity (2.134 per 1000 workers), this indicator decreased by 90.7% to 0.198 per 1000 workers. (Fig. 1).

This is due to the fact that the production uses outdated equipment and technological processes that do not meet hygienic requirements, or there are no protective equipment or are in a faulty condition, etc.

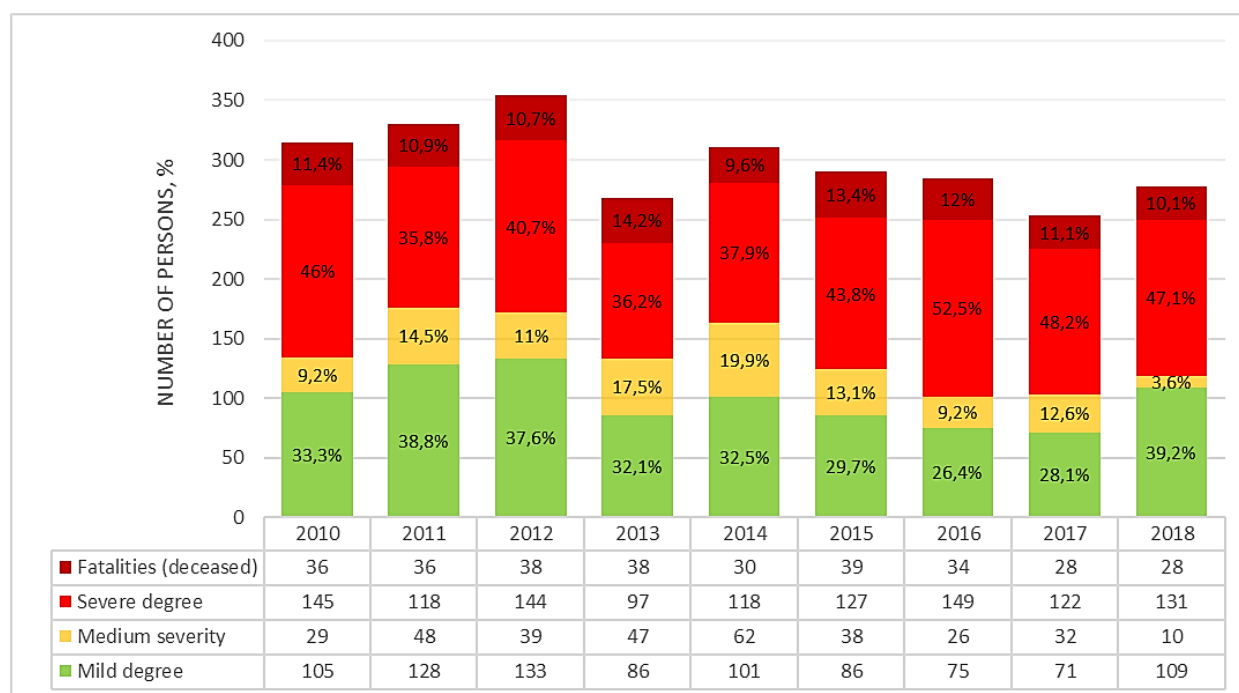


**Figure 1 - The number of victims of accidents, including deaths per 1000 workers, in the mining industry in the period 2008-2018**

The analysis for 2008 - 2018 in relation to the total number of the employed population in the mining industry indicates a positive trend in the decrease in the number of victims with an annual increase in the number of the employed population. If we consider the indicators of occupational traumatism in the gender aspect in the mining industry, we can note the dynamics of a decrease in the number of injured among both genders.

During the analyzed ten-year period, the number of affected men decreased by 35.8% (607 people - in 2008 versus 390 people - in 2018), among women it decreased by 60% (35 people - in 2008 versus 14 people - in 2018).

As shown in Figure 2, with the general trend of a decrease in the number of injured and fatalities in accidents for all degrees of severity of the outcome, the share of severe and fatal outcomes over the past 4 years (2015 - 2018) averages 59% of the total number of victims.



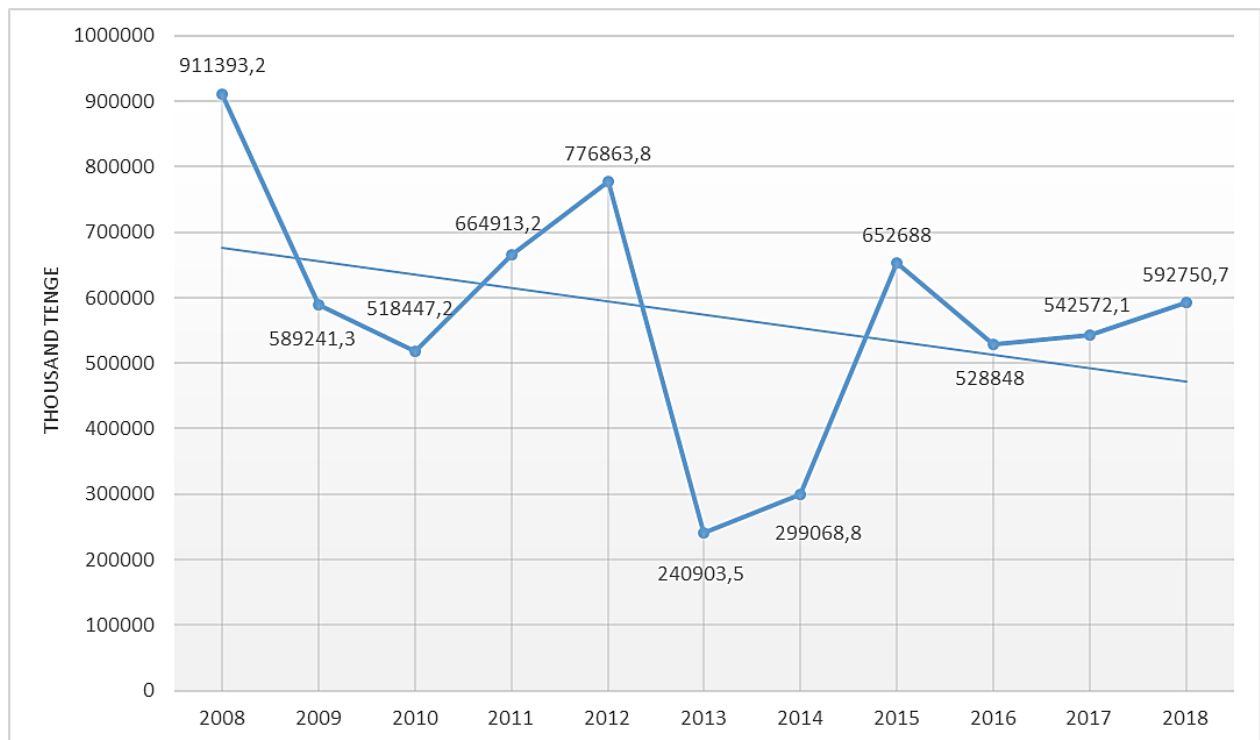
**Figure 2 - the outcome of a mining accident in the period 2008-2018**

The problem of industrial traumatism should be considered not only medical, but also socio-economic, since the decrease in the level of mortality and disability from injuries represents a large reserve for saving public funds and one of the foundations of the social policy of the state as a whole [21].

The quality of the state's labor resources, labor productivity, and the value of the gross domestic product produced are behind the preservation and strengthening of the health of the able-bodied population, that is, a working person - a producer of material goods.

So, in 2019, in the formation of the GDP of the Republic of Kazakhstan, the main share is made by the mining industry and quarry development: 15.7% of the total volume. Moreover, the sector's contribution to government revenues reached 44%. If in 2018 the contribution to the GDP of the mining industry amounted to 6,337.5 billion tenge, then in 2019 it increased by 9.6% and already amounted to 6,945.0 billion tenge.

The economic development of most countries is accompanied by an increase in the consumption of raw materials and energy, which requires an increase in the output of the mining industry. Analyzing the situation with traumatism and occupational morbidity in the mining industry, we can conclude that every accident that occurs, in addition to social damage, brings large material losses to the state. (Fig. 3)



**Figure 3 - Material consequences of accidents in the period 2008 - 2018 (thousand tenge)**

If earlier in 2008 the material consequences of accidents reached 911.3 million tenge, then this indicator, as seen from the trend line, decreased by 53.8% by 2018 and amounted to 592.6 million tenge.

## Conclusions

Between 2008 and 2018, there has been a positive trend, the number of men affected has decreased by 35.8%, and among women has decreased by 60%. The decrease in the level of occupational morbidity and industrial traumatism is due to some improvements in the quality of the annual periodic medical examinations due to the participation of occupational pathologists in the composition of medical commissions and more active appeals of the workers themselves for occupational pathological care. This contributed to the fact that occupational diseases began to be diagnosed in the early stages of the development of the disease.

With the general trend of decreasing the number of victims and deaths in accidents at all severity of the outcome, the proportion of severe and fatalities for 2015 - 2018 is on average 59% of the total number of victims. Despite the downward trend in the number of injured and fatalities in accidents during the analyzed period in the mining industry, the overall level of industrial injuries and occupational diseases in the country remains high, it requires special attention and implementation of measures based on the results of assessing working conditions.



According to the situation with the material consequences of accidents, it can be concluded that each accident that occurs, in addition to social damage, brings large material losses to the state. Good working conditions, concern for the welfare of employees and a well-built system of monitoring indicators, problems and issues related to labor protection will reduce the level of industrial traumatism and occupational diseases, reduce the number of sick people and increase labor productivity and production volumes.

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